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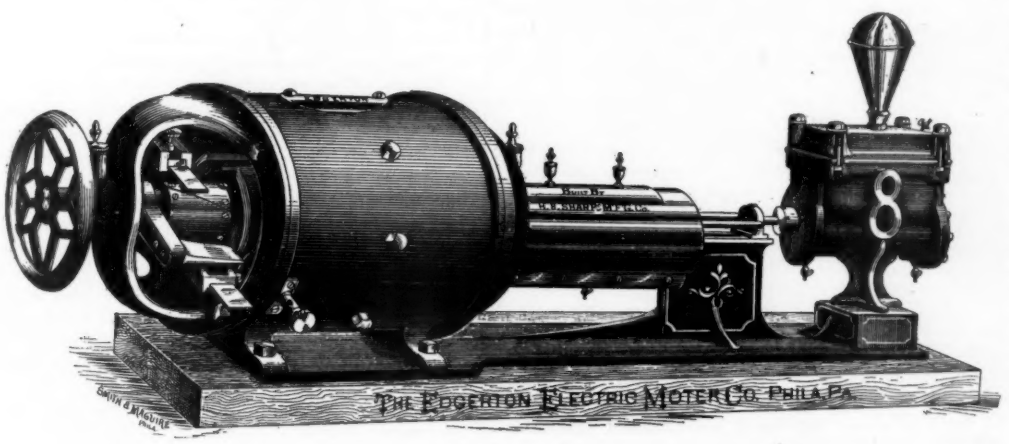
New Direct-Acting Edgerton Electric Pump.

The Edgerton Electric Motor Company, Philadelphia, exhibited their new direct-acting high pressure electric pump at the Boston meeting of the National Electric Light Association, and since that time have received a number of orders from parties who witnessed the efficient work of the pump on that occasion. The illustration we present on this page, shows the arrangement of pump and motor, giving an excellent idea of the simplicity of the combination and of the solidly constructed parts.

Through this improved construction, the direct action of the motor is secured without the aid of cog wheels or cams, and the parts used to convey the power from the motor to the pump are of such simple form that long life is obtained for those parts, which usually are the first to give out. This pump is, we believe, the first invention of the kind, and the fact that the motor is slow-speed is what enables the manufacturers to accomplish such valuable results.

The pump that was shown at Boston was drawn by a one-half horse power Edgerton motor. The capacity of the pump was 300 gallons per hour, the pump being double-acting, and working under a pressure of 42 pounds to the inch. The entire floor space occupied was three ft. long by ten in. wide, as will be noted, requiring a very small space in which to operate. The manufacturers have found quite a demand in large buildings where there is no comprehensive protection against fire, the pump being always ready for action, only requiring the turning of a switch to bring it into use, also at large country houses, where it is necessary to force water from the well to the house and stables. The pumps are manufactured in various sizes to suit the demands of each case.



ELECTRIC PUMP OF EDGERTON MOTOR COMPANY.

Western Union Share-Owners Indorse the B. and O. Purchase.

J. PIERPONT MORGAN TO ACT AS ARBITRATOR IN SETTLING MINOR DETAILS—PRESIDENT GREEN, "SPEAKING GENERALLY," DECLARES THAT RATES WILL STAND "ABOUT AS THEY NOW ARE"—EXPENSES TO BE RETRENCHED.

At the annual meeting of the stockholders of the Western Union Telegraph Company held last week, 586,000 shares were represented. The purchase of the Baltimore and Ohio lines was ratified. With the substitution of Charles Lanier, of Winslow, Lanier & Co., for Robert Lenox Kennedy, the old Board of Directors was re-elected, and Dr. Norvin Green submitted his annual report.

The contract ratified was to the effect that the Western Union pay $5,000,000 of its own stock for the Baltimore and Ohio system, $60,000 a year for the Baltimore and Ohio Railway Telegraph Company, and the railroad to retain control of an exclusive line of poles and wires between New York and Philadelphia. The Western Union did not pay the actual stock, but executed a note for the 50 000 shares, payable at the option of the company within sixty days from Oct. 5. The lease of the railroad lines at $60,000 annually is for fifty years. J. Pierpont Morgan is to act as arbitrator in case of any differences arising between the contracting parties in the settlement of details The meeting authorized the issue of the $5,000,000 new stock to take up the note, thus increasing the capital stock of the company to $86,-200,000. Samuel Sloan acted as chairman.

Dr. Green's report of the year's business showed that the aggregate revenues of the Western Union for the twelve months ending June 30, 1887, were over $17,000,000. The expenses were something more than $13,000,-000. The profits, therefore, were above $4,-000,000. A quarterly dividend of 1 per cent. was paid. The sinking fund appropriations amounted to $39,991. With these deductions there remained over $2,500,000 to be added to the surplus, which now aggregates $7,000,000. Of the $13,000,000 expenses, $9,000,000 went for operating expenses, nearly $2,000,000 for leased wires, and the remainder for maintenance, construction and equipment of offices. The report stated that the expenditures for reconstruction were on important trunk lines, which may now be maintained at a slight cost for years.

There has been an increase of 4,104,723 in the number of messages carried over the previous year. This is the largest increase recorded since 1881, after the acquisition of the American Union and Atlantic and Pacific companies. The average rate received per message was 30¼ cents, as against 30 9-10 the preceding year. The cost of handling was reduced from 24 cents to 23¼ cents. The report concludes by pointing out that on this basis of cost for handling, every message transmitted and delivered at 10 or 15 cents represents business at a loss, and that even city messages cannot be taken profitably at 15 cents for ten words. In calculating the number of messages transmitted, every thirty words of press service is taken as a message. Commercial messages average seventeen to twenty words.

In speaking of telegraph matters after the meeting Dr. Green talked freely. He said:

"Including the Baltimore and Ohio wires we have, or will have by the end of this year, about six hundred thousand miles of wire stretched through this country. That would go around the earth something like twenty-four times. The pole mileage is 162,000. The Western Union wires on July 1 were 524,641 miles. Since then we have built 10,000 miles. The Baltimore and Ohio wires make about 60 000 miles more. This brings up the wire mileage to 594,000. The 6,000 miles difference between that and 600,-000 will be strung by Jan. 1, 1888."

"When will the consolidation of the two companies actually occur?"

"We shall go to work closing up offices as soon as possible. Many of them are leased for the year, and we shall have, of course, to make arrangements to sublet, or to make some other disposition of them. All this takes time. But we will not delay cutting down expenses a moment more than is necessary. We shall get rid of all the expensive terminal properties in this city and in other large commercial centers, which means thousands of dollars of annual outlay for rent. I believe that we shall be able to do the business of the Baltimore and Ohio lines for about 40 per cent. of what it cost them. They claimed that their business was $2,000,000 a year. As far as we can learn it amounted to $1,500,000, and they expended about that much for operating expenses and construction. If we can do that business, as I say, for forty per cent, or $600,000, there is a margin of $900,000 profit at once."

"Will you advance rates at all?"

"Nothing of the kind has been discussed. Speaking generally, I may say that the rates will stand about as they are now. We won't do any 10-cent business, and there is some doubt about continuing the 15-cent rate to distant points. There is no money in it. If the communication is direct, as between a broker's office in New York and the Board of Trade in Chicago, where there is no messenger service required and where the message is delivered on the floor, the 15-cent rate might be passed, but to transmit and deliver at a house or an office, the expenditure for messengers, cuts away all possible profit."

"Will D. H. Bates, President of the Baltimore and Ohio Telegraph Company, be retained in the Western Union service?"

"That is a question I cannot answer."

Mr. Bates has a contract with the Baltimore and Ohio lines, at $15,000 a year, which does not expire until Jan. 1, 1889.

Electrical Installation at Greenwich, Ct.

Mr. E. H. Johnson, of the Edison Company—president of the lighting corporation—has demonstrated in his magnificent country house at Greenwich, Ct., what electricity can be made to do in adding comfort, splendor and luxury to home as well as in adding wealth to one's pocket. In that luxurious Yankee village, writes Julian Ralph, where the thieves of the Tweed ring spent their quarry in prodigal splendor at the Americus Club, and where a Standard Oil magnate has since built his palace, the house of this electrical millionaire is the grandest establishment. It is an enormous three-story dwelling in the colonial style, set in a three-acre lawn and occupying the highest land directly on the coast between Maine and the Everglades. It fairly glows with electricity at night; it is a lantern in effect—a beacon in that countryside. The two great drives that wind through the greenery of the park are fringed with electric lights, a wondrous cluster of carbon loops hangs in a chandelier under the arched entrance to the mansion where the drives terminate, the great verandas around two stories of the mansion glitter with these lights, and the tower surmounting all blazes like a lamp above the trees. All through the house are faucets for throwing on the brilliant lights, sometimes in the oddest shapes, as in the hallway, where the grained arches terminate in great suns of glass, which, when lighted, cast a soft light in the atmosphere, and at the same time reveal a grotesque, but artistic figure of a solar countenance in each flowing orb; an electric fountain blazes in the lawn, and a score of sunken lights, hidden in the grass, illuminate the tennis ground for those who wish to play at night. The machines that supply the fluid for the lamps also conduct it to the telephone and to the delicate instruments that tell the family the temperature indoors, the force of the wind without, the degree of heat or cold out of doors, the force of the electric currents through the house and the pressure on the boilers. The same current guards the house and grounds like a police force. Let any one try to open the gate to the park or seek an entrance to the mansion by door or window, and he will set the secret forces to blabbing loudly of his folly. This same Jack-of-all-trades that does all this so modestly and quietly also turns the great blower that forces fresh air into the house and works the dampers of the ventilators and heaters, keeping the atmosphere of the house at whatever temperature is desired.

As soon as possible, perhaps it is now, the same mysterious force will work the churns, make the ice for the household drive the lawn-mower, and do a score of helpful things about the house and grounds, which Mr. Johnson has planned to have performed. And all this is brought about by a noiseless steam engine running the needed dynamos in a room in the outbuildings where the help live, the 15 horses of the establishment are kept, and where the family and guests repair to bowl or play at billiards.

Resignation of President Garrett.

At the monthly meeting of the directors of the Baltimore and Ohio Railroad Company a letter was read from Mr. Robert Garrett, resigning the presidency of the company, as follows:

"*To the Directors of the Baltimore and Ohio Railroad Company.*

"GENTLEMEN: It is well known to many of you that it has been for some time my fixed desire and intention to withdraw, when I properly could, from the labors which have been imposed upon me by my official position as president of the Baltimore and Ohio Railroad Company. But, as you are also aware, the policy and undertakings of the company, which I necessarily assumed at the time I accepted the presidency, were such as to render it improper for me, with a due regard to the interests involved, to withdraw from their prosecution. Now, however, that arrangements have been made, which, as I hope and believe, will secure many of the ends for which we have so long struggled, and the business and the finances of the company being in a sound and satisfactory condition, I am in a position to tender you, as I do hereby, my resignation as president of the company.

"I thank you for the courtesy and consideration which you have uniformly extended to me; and I trust you will be able, within a brief period, to fix upon a proper person to whom I may surrender the trust with which you have honored me.

"I am, very respectfully,

"ROBERT GARRETT."

Complimentary remarks to Mr. Garrett were made by Judge Dobbin, on behalf of the Johns Hopkins University, and by J. McKenna White, on the part of the city of Baltimore, after which the resignation was accepted.

The following resolution was then offered and passed unanimously:

Resolved, That, on accepting the resignation by Mr. Robert Garrett, of the presidency of this company, we do so with deep regret. We know how earnest has been his desire to withdraw from the exacting duties of the office, and how imperative, up to this time, has been the necessity that he should not do so. Many of the measures of policy, whose completion was undertaken when he became president, have been pursued with difficulty and peril, till their success is no longer doubtful. We appreciate the fact that this result has been largely due to his courage and unselfish devotion to the company's interest, and congratulate him upon the fact that in leaving the office at this time, he not only does so with the affection and respect of all those connected with the company, but with a recognition by all those acquainted with it of how great have been the services he has rendered.

The contract for the transfer of the Baltimore and Ohio Telegraph to the Western Union Company was approved. A resolution was adopted that no dividend be declared from the earnings of the main stem for the past six months, and declaring a dividend of 5 per cent. from the earnings of the Washington branch. Robert Garrett was elected a director in the company in place of John Spear Nicholas, deceased.

Mr. Garrett has been at the head of the road just about three years. He succeeded John King, jr., as vice-president in 1881, and in November, 1884, he was elected president. His father died in September of that year. Robert Garrett's fortune is estimated at from $12,000,000 to $ 5,000,000. A year ago, when he had found what a burden the management of a great corporation, with a telegraph department, an express department and a sleeping car department meant, he expressed his willingness to retire as soon as a satisfactory successor could be obtained. He is about forty-two years old.

*** According to the proceedings of the Belgian Society of Electricians, the Van Rysselberghe system is applied to over 9,000 miles of line, of which nearly 4,500 miles are in Belgium, about 2,500 miles in France, about 600 miles in Germany, and the rest in Austria, Bavaria, Denmark, Spain, Holland, Switzerland and Wurtemburg. The system is in process, or is projected, some 3,700 miles in addition to the above, some of these extensions being in Turkey, Russia, Roumania, Portugal and Italy. It will be recollected that this system permits of utilizing the same wires for telegraphic and telephonic communication.

"Electrical" Charlatans.

It would be difficult to name an honorable profession more degraded by dishonorable outsiders than that branch of engineering which deals with the marvelous phase of energy called electricity. The number of men who deserve the distinguished title of electrician is very small. The number of men who are fit to control this subtle force,—whose qualifications, although not of a highly scientific nature, are entitled to the appellation of electrical engineer—is far below that of any other profession; while the charlatans who trade upon the ignorance of the public on electrical matters, and help to obstruct the progress which would undoubtedly follow each surprising discovery, if these blockheads would only remain in the sphere for which Nature intended them, are found in every part of the kingdom, playing with a force the very elementary principles of which they do not understand. In dealing with this important question, we must risk offending any class of men who disregard the old adage, "Let the shoemaker stick to his last." There are, it is true, men, and women too, who display a surprising versatility of talent. In literature, we find the scientific writer making a reputation as a novelist. There are mechanical engineers who have done great things in the electrical world, but these clever "all-round" men are made of different stuff to the nobodies who, after having failed at everything they have hitherto attempted, take up "electrical engineering" as a last resource. The first electrical charlatan to notice, and for whom we have a great contempt, is the ironmonger, whose wretched attempts at electric-bell fitting and the maintenance of batteries has prejudiced a large number of people who now speak of electric bells as nuisances instead of almost indispensable conveniences. Our readers will scarcely believe it possible that a respectable ironmonger could display his ignorance to such a lamentable extent as to join zinc to zinc in an electric battery, thus making a fault instead of remedying one. This piece of "skillful" workmanship came under our own notice about two years ago. A lady who had employed this tradesman was worried to death with her bells, and in a moment of despair she called upon us and asked our advice. We recommended a qualified man, who declared that he had never seen "such a mess in his life." The connections resembled plumbers' joints. Zinc was joined to zinc in the battery, and everything was done to prevent the proper working of the circuit.

This is not an isolated case. We could fill columns with stories of ironmongers' "electrical engineering," but we must be content to dismiss this nuisance with the following: A dirty-looking young man once called upon us, handing a well-thumbed type-printed card, bearing the unwashed one's name, followed by the word *Electrician*. The name being strange to us, we asked our visitor from whence he hailed. "Oh," he replied, "I am assistant to Mr. Ferrum, ironmonger, of Kensington." "And you are the electrician to the establishment?" "Yes, I do the bell work." Tableau! Then there is the youth who has read as much as he could understand of an elementary text-book, and who has constructed a rude electrophorus out of a dripping-tin and a cake of resin, a galvanometer by coiling a few turns of wire round a compass-box, and sundry other primitive machines. This youth is the genius of the family. He has a soul above quill-driving. He must be an electrical engineer. Taking advantage of a sudden demand for men with electrical knowledge, he manages to get a situation, being ready with his set phrases, in which volts, ohms, and amperes are plentifully besprinkled. We next find him in charge of a dynamo, and shortly after read the account of his death caused by shunting some of the current into his own body. The inquest follows, and the father of the genius confesses that his son was very fond of reading electrical books, but that he had never had any proper training. To read about the potent force is harmless recreation, but to play with it sometimes means death.

Passing by a variety of electrical charlatans who do neither good nor harm, we come to the self-styled "medical" electrician—the vampire who coins money where professional men fail.

The "medical electrician" is generally an ignoramus who is hardly able to speak six consecutive words of the English language correctly. He belongs to what Carlyle would have called the foxy type of mankind. He begins life as a porter, a warehouseman, or a small shopkeeper. He is shrewd, and possesses certain business qualifications which would lead him on to success if his nature would only permit him to deal honestly with his customers or employers. He is not satisfied with the humdrum life he is leading. He thirsts for gold, and although he has neither the manners nor the education of a gentleman, he aspires to something higher than the rewards which await the honest trader. He must have notoriety as well as "filthy lucre." This sharp little animal looks out for a big swindle, something that will keep him without the pale of the law, and, at the same time, allow him to fleece the easily duped British public. Pills have been worked to death; ointments are a drug in the market; betting is risky; and the "Employment in your own Homes" dodge has led a few of its promoters to her Majesty's hotels.

A bright idea illumines the small brain of Reynard. "Electricity is the thing. The public know nothing about it—no more than I do. There is always a mystery about electricity. That it is a valuable agent in the treatment of disease there can be no doubt. All I have to do is to declare my special appliance as the only true panacea for all the ills that flesh is heir to. Advertise well and judiciously, and the public will flock to me and pay me five guineas for that which they could get elsewhere for as many shillings." Thus reasons the quack medical electrician. He works up a pamphlet giving quotations from writers on electro-therapeutics, carefully omitting every word the authors say about the dangers attending the administration of electricity by unqualified and unskillful persons. If he professes to cure all diseases by means of magnetism he cautions the public against strong currents of electricity, claiming for his bits of magnetized steel the most wonderful virtues ever discovered since Hippocrates of Cos attempted to base the practice of medicine upon rational scientific principles. If he decides upon electricity then he condemns magnetism and stitches pieces of zinc and copper upon his belts, chest-preservers, wristlets, etc., manufacturing so-called electric appliances which are quite as worthless as the shams he professes to expose. His literature is prepared by hard-up scribes, or men with less principle than brains. Sometimes the self-styled eminent one will even dare to suggest to a professional man that the latter shall descend from his pedestal to the low level of quackery and join him in robbing the public. Happily this scheme has never been known to succeed, and we are not able to name a single member of the Society of Telegraph Engineers and Electricians who is associated with one of these charlatans. The "magnetic men" visit all the principal towns in this country. They issue well-printed and artfully-written pamphlets and circulars. Some use religion as a cloak, studying a number of cant phrases, which are ready for use when the victim is known to be particularly devout or whenever a clergyman visits the "electrical humbug." These impostors succeed in getting testimonials from old ladies and weak-minded individuals. Indeed, we have seen the names of medical men appended to their lists, men whose scientific training ought to have served as a shield to guard them from these itinerant electrical charlatans.

We have defined three classes of "electrical" quacks. It is now our duty to define a properly-qualified electrician, or, at least, to state what we consider a man ought to thoroughly understand before he is fit to practice as an electrician.

To begin with, the electrician ought to have had a liberal education, the scientific part of which could not be considered satisfactory without a thorough grasp of the correlation of forces or the conservation of energy—the key to all the sciences. A sound knowledge of inorganic chemistry and the laws of electrolysis is indispensable. Also a more than superficial study of the laws which govern the phenomena of heat, light and sound. His electrical knowledge should comprise the molecular theory of electrical energy; and he ought to be able to take up Kempe's "Electrical Testing" at a moment's notice, and explain the rationale of any method therein described, or to work out on paper the relations between horse power, current electromotive force and resistance, in order to give estimates for electric lighting, etc. Kirchoff's law, and the practical working of the Wheatstone bridge, ought to be at his fingers' ends, besides a good training in the higher branches of mathematics. Telegraph engineering, inland and submarine, which includes skill in locating faults on land and submerged wires, ought to form part of his curriculum. Practical instrument making must not be neglected; for we should not think much of an electrician who could not make or at least superintend the manufacture of induction coils, telegraphic apparatus, batteries of all kinds, condensers, etc. And last, although not least, our electrician ought to be well acquainted with the literature of his profession, and the names and labors of the suns and planets of the electrical world ought to be as familiar to him as household words.

In addition to the above qualifications, the medical electrician ought to have studied human anatomy and physiology for at least four or five years. The physiological effects of electricity should have been his special study, and, in order to practice localized electrization with success, all the motor points of the human body should be quite familiar to him, as well as a sound knowledge of electrolysis and animal chemistry. The more he knows of morbid anatomy the greater his chance of success as a medical electrician. Above all, a severe course of study with practical experiments in electric posology is a *sine qua non*.

Having given a rough definition of an electrician, the next question to consider is how can the profession and the public be protected from the horde of ruffians who bring disgrace upon an honorable calling? The pure scientist will often starve while the rogue, who has no reputation to lose, and who rushes in where angels fear to tread, will speedily reap a golden harvest; and where is the remedy? We want protection from the law. An act ought to be passed to render any unqualified man practicing as an electrician liable to a heavy fine or imprisonment. Before 1868 any person could set up as a dentist, and no one interfered with him; but now if a man who is not on the dental register advertises for patients, he can be prosecuted by the Medical Council, and the informer is rewarded. Is it not possible for the electrician to get the same protection? If we are to spend long years of patient study in the investigation of Nature's laws—study which in some instances shortens a man's life—and then to be outwitted by sharpers whose impudence is only equaled by their want of principle, by charlatans who are not able to speak their own language, then we strongly advise the youth of to-day to try some other profession, and pause before he enters the arena with the electrical charlatan. — *The Telegraphist.*

** The heat evolved by electric lighting is about to be turned to profitable account by the Societé des Usines Electriques, of Berlin, which has announced that, in future, in addition to light, it will be prepared to furnish a supply of electricity for heating purposes. The appliances which the society offers to its customers have been constructed with a view to the use to which they are to be put. For instance, for boiling water it has contrived a vessel having two cases, between which is placed a resistance coil. It is stated that, with this appliance, about one and a half pints of water can be raised to boiling point, with four amperes, one hundred volts. In certain theaters electric stoves are employed for heating the curling tongs, the use of gas jets and spirit lamps being rigorously forbidden.

Practical Electrical Measurement.

BY J. SWINBURNE.

Incandescent Lamps.

Incandescent lamps have to be tested as to candle power and as to life. As there are very many popular errors as to incandescent lamps, it is advisable to go into the matter somewhat fully.

As a solid opaque body is gradually heated it throws off energy in the form of heat and light. At a low temperature it throws off heat only, but on becoming luminous it gives out red light. As the temperature is increased it adds yellow, and so on till it gives a complete continuous spectrum. As the temperature is increased the intensity of all the different colored lights increases, but the last added increase fastest. Thus, as the body rises in temperature the light increases faster than the heat radiation; and the yellow, and finally the blue lights increase more rapidly than the red, so that the body not only gives more but whiter light.

When a certain power, say for instance 50 watts, is spent in a lamp carbon, the temperature rises until the emission of energy by radiation and the loss by conduction is equal to the power supplied. If the body is in what practically amounts to a vacuum, so that the loss by conduction or convection may be disregarded, the radiation need alone be taken into account. If the body has a large surface it will be able to radiate all the power at a comparatively low temperature. The smaller the surface the higher will the temperature be to radiate a given power Temperature and surface are not the only factors, however, for a piece of black carbon and a piece of silver of the same size and a the same temperature would not radiate the same quantity of energy per second; that is to say, they would not get rid of the same amount of heat per second, or give the same light. They would not, therefore, require the same power to keep them at the given temperature.

Though two bodies with the same surface area, but with different emissivities, would not emit the same light or heat, they would emit light of the same color. That is to say, the proportions of heat and of lights of different colors in the two cases would be the same, though the total emission would be different. The piece of black carbon would thus give more light than the silver, and would also radiate more heat; but the ratios of the light to the heat in each case would be the same. The power taken to preserve the bodies at the given temperature would, therefore, be in proportion either to the heat radiated or to the light emitted, or to the light of any one color emitted; that is to say, they would have the same efficiency as to light given and power absorbed.

We thus arrive at a most important law in the theory of incandescent lamps, namely that incandescent bodies at the same temperature give light of the same color, and are at the same efficiency; that is, give the same number of candles per watt.

Mr. Bottomley has read a paper at the British Association this year, giving an account of some experiments as to color and temperature. His conclusions are opposed to those generally accepted by physicists, and before they can be accepted a great deal more evidence must be given. Mr. Bottomley apparently regards his paper as a mere first notice, and intends to continue his important experiments. At present it may be suggested that his arguments as to Mr. Evan's experiments are open to criticism. The resistance of a lamp carbon varies with the temperature in accordance with no evident law; and the color of the light and radiation depends on the surface temperature, whereas the resistance depends on the temperature of the whole carbon. A carbon of high emissivity would need a higher internal temperature to preserve a given surface temperature than one of low emissivity. The same reasoning applies to two platinum wires, one of which is blackened. Besides, Mr. Bottomley does not state whether the lampblacked wire was heated to incandescence before the tube was sealed off the pump; and if it were not, it would be coated with hydro-carbons, which would spoil the vacuum in that tube. It is, no doubt, unlikely that one so careful as Mr. Bottomley would make such mistakes; but, on the other hand, his results are so opposed to those of others that they must be disregarded for the present; and the law that efficiency is a test of surface temperature, and color is a test of both, may be taken as true.

It has been so far assumed that none of the power is lost by convection. In a lamp, power is, of course, lost in this way. If it is appreciable, efficiency is obviously no longer a test of temperature; but color is so still. Convection may be taken as constant, or disregarded, except in the case of a bad vacuum.

As the efficiency depends on the temperature, the aim of a lamp maker is to produce a carbon that will stand as high a temperature as possible without breaking. Nothing can be gained by using a white surface or a black surface, unless one only exists with a stronger carbon.

The emissivity of the different carbons used by lamp makers may be taken as the same; the light of any given lamp then depends simply on the surface area and the temperature, or on the area and the electrical power. Efficiency is not a quality inherent in a lamp, To say that a given lamp has an efficiency of this or that is nonsense; any lamp may be run at any efficiency under its breaking point. If run at a low efficiency it is at a low temperature, and is therefore less likely to break; but it gives less light per watt, and therefore costs more in electrical power. Lamp efficiencies are generally taken backwards. Instead of following the usual practice, and saying, for instance, four watts per candle, the writer prefers to say .25 candles per watt, or .25 C.P.W.

The term "candle power" is also generally used without any definite meaning. A lamp emits more light in some directions than in others. For instance, a thin flat carbon gives very little light edgeways, and a great deal flatways. Its power of illuminating a room depends on the total emission, so that if the emission in one direction were alone taken it would be no measure of the light given. If the mean of the emissions in every direction could be taken it would no longer be fair to compare incandescent lamps with gas jets, as the horizontal emission of a gas flame is alone taken. To avoid these difficulties, the writer always defines the candle power of a lamp as the emission in a horizontal direction of a cylindrical carbon of the same surface held vertically. This has also the advantage of being almost always easily determined.—*London Electrical Review.*

The Babcock & Wilcox Boiler.

The extensively-used boiler of this company is being received with much favor in electric lighting circles, and deservedly so. The illustration we give in this issue is of their water tube boiler, the kind that has just been placed in the new building of the Electric Club on 22d street, this city.

A series of thirty very elaborate tests of these boilers, in various parts of the country, and with all kinds of fuel, show an average evaporation into steam of 11.42 lbs. of water per pound of fuel—a very remarkable showing, indeed, and one which has so successfully appealed to the judgment of the owners of electric lighting plants particularly.

The Babcock & Wilcox is a plain cylinder boiler, serving as a steam and water reservoir, placed above and connected at each end with a nest of inclined heating tubes, also filled with water. The rear and lower end of these tubes are connected to a mud-drum at the point furthest removed from the fire. The heat is applied to one-half of the cylinder and all the tube surface.

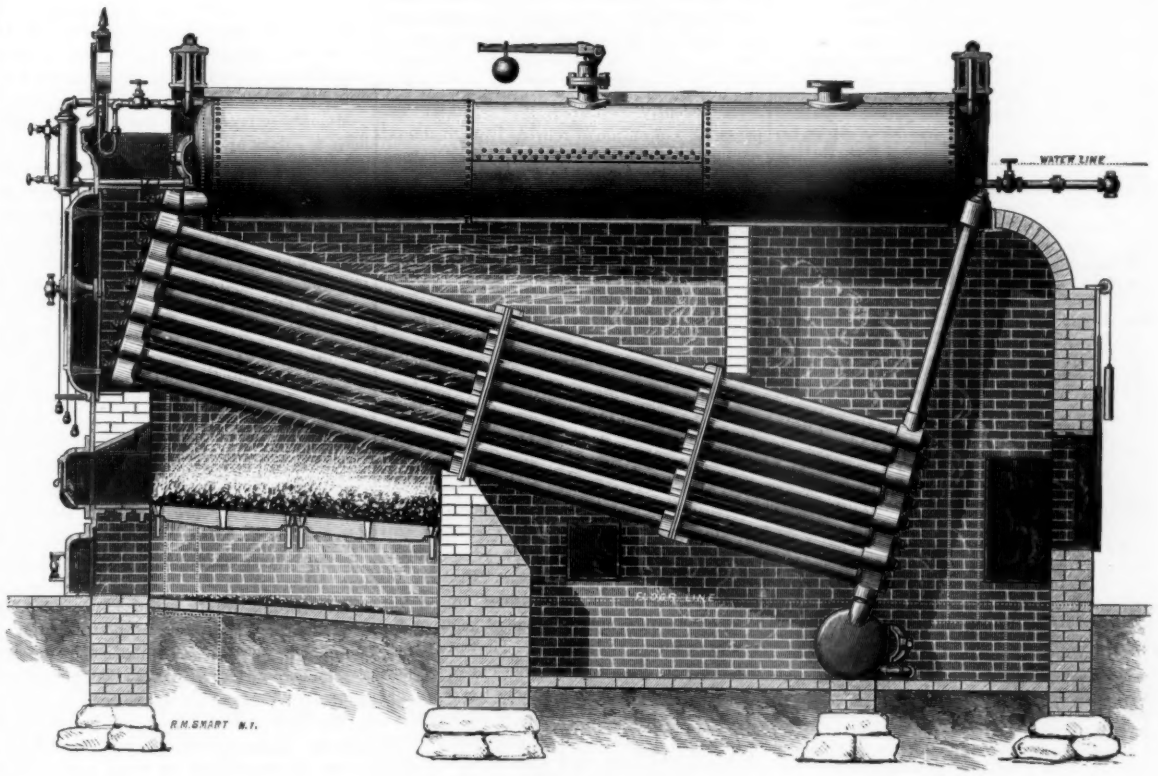
Every square inch of the boiler, inside and out, is in sight, and accessible for mechanical cleaning through a manhole in the cylinder, handholes in the mud-drum, and hand holes, having milled faces, opposite each end of every tube for the interior, and through cleaning doors in the walls for the exterior surfaces.

All joints between the several parts are made by expanding tubes into taper seats, and increased pressure tends to increased tightness.

The boiler-setting forms a furnace, in which all the heating surfaces are enveloped by the hot products of combustion, as they rise from the grates situated under the front and highest end of the tubes, passing at right angles across them three times, and once under the whole length of the cylinder, before being discharged into the stack, at a greatly reduced temperature.

As the water inside the tubes becomes heated, a mingled stream of steam and water is discharged into the front end of the cylinder above, where the steam gradually separates from the water, the latter flowing to the rear end of the cylinder, and down again into the tubes, making a rapid and continuous circulation of all the water in the boiler, keeping all parts at a uniform temperature, and avoiding strains from unequal expansion. This rapid circulation also serves to sweep away the steam bubbles from the heating surfaces, as fast as formed, supplying their place with water, thus increasing the efficiency of the surface. It also serves to carry any sediment contained in the water into the mud-drum at the rear and lowest point in the boiler, from whence it can be blown out.

The steam is taken out at the top of the steam drum at the rear end.



Babcock & Wilcox Boiler.

A New Accumulator.

Writing to the *Engineer* from Sydney, Mr. W. T. de L. Roberts says:

"I have been experimenting with electric accumulators, and wishing to have a more efficient one than I could buy, I made two cells which were a slight modification of the 'Plante' and 'Union battery' combined, which gives—to me—a wonderful result. I have one pair of plates only four inches by four inches for each cell, and having connected them in quantity with my other accumulators, worked them up together for some weeks, every evening running them partially down to light the house. When I considered the new cells ought to be worked up, after charging them for a day I disconnected from the main and connected in series with a five-volt lamp to test the capacity. After burning for three hours I was compelled to leave it, so I disconnected for the night without recharging and lit up again next morning. The whole of that day it remained burning, so I was again compelled to disconnect for the night. The next evening I lit up again, and so on every evening for two, three, or four hours, until I had obtained over 35 hours work from the two cells, extending over 11 days. After that the lamp would not burn for more than one hour at a time without getting duller, but seemed to recover itself after a few hours' rest, losing from 12 to 14 minutes in duration regularly each day. Now, I am not aware that either the 'Plante' or 'Union battery' will give anything approaching this result. Perhaps some of your readers can tell me if such a result has ever been obtained. The loss of 12 to 14 minutes a day must principally be due to leakage, because I had taken no special care on that point, and my old accumulators placed in the same position would be nearly emptied through leakage alone in 10 or 12 days."

—— Some of the recent electric motor storage battery trials again call attention to the futility of such public exhibitions when proper mechanical devices have not been provided. Undue haste in these cases is particularly unfortunate, and prevents proper presentation and appreciation of the work of electricity in this direction.

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GEO. WORTHINGTON, - - - Editor.
CHARLES W. PRICE, Associate "
T. J. McTIGHE, Electrician and Manager Patent Bureau.
LOREN N. DOWNS, President.
ANDREW J. DAM, - Vice-Pres't and Treas.
C. C. HASKINS, } Consulting Electricians.
GEO. A. HAMILTON, }

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Frank M. Gilley, 54 Equitable Building, Boston, Mass., is our New England representative.
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NEW YORK, OCTOBER 22, 1887.

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Now is a good time to start new telegraph companies.

The printers' strike caused a slight change in the make-up of the REVIEW this issue.

Charles F. Cutler, President of the N. Y. & N. J. Telephone Co., has returned from Europe in the best of health.

Mr. J. Swinburne, one of England's foremost young electricians, is visiting this country for a short time.

Mr. Allan V. Garratt, editor of *Modern Light and Heat*, and Secretary of the Boston Electric Club, was married in that city on Thursday, October 20th. The club attended the wedding in a body. The REVIEW extends its most cordial congratulations to the capable young editor.

After a very thorough test, the officials of the telegraph administration in Germany have condemned accumulators, as unfit for commercial telegraphic work, and report that they can replace primary batteries in a few extraordinary instances only, but that in the majority of situations the primary battery gives the best satisfaction.

A new and very promising electric motor is presented from Hartford. The Eddy Company have thoroughly tested a new motor, constructed mainly on the plan of the Mather dynamo, and have met with most gratifying results. The first one constructed is in daily use in a printing house in Hartford.

A recently captured Boston thief expresses his intention of retiring from business. "The electric light" he says, "has ruined our profession. Why, the electric light in Boston is worth 300 policemen to that city." This is an excellent recommendation for the electric light, though from a questionable source. President Gilbert of the Boston Electric Light Company will now point with pride to the fact that he is a public benefactor.

The police signal boxes, or street telephone stations, are by many considered (through "association of ideas," merely, as they are not intrinsically ugly) an eyesore, as at present constructed, and are, as the testimony taken before the aldermanic special committee proved, says the Boston *Transcript*, often erected in very inconvenient places. Both the architecture and the location of these boxes might be improved upon, but the objectionableness of some of them ought not to condemn the system. They are a very desirable addition to the police conveniences, and likely to prove, as they have proved elsewhere, of immense value in emergencies. They have been erected on trial, and are not so formidable that they cannot be removed or replaced if they have been erected in inconvenient locations. When the system has become permanent, it may be possible to set them into the walls of buildings, leaving only the door showing. They would be quite as convenient as when set on the sidewalk, would not be offensive to the sight nor obstruct the way, and could not be upset by rowdies.

QUERIES AND ANSWERS.

To the Editor of Electrical Review:

Please answer the following questions in your paper, and oblige a subscriber.

1. What kind of insulating substance is used for insulating the wire of the fields of a dynamo? 2. If an electro-magnet is excited by a current, does the magnet tend to produce an E. M. F. in the opposite direction at the time when the circuit is broken? 3. Can a Leyden jar or secondary battery be charged with a voltaic pile?

YOUNG ELECTRICIAN.

Prescott, Oct. 10, 1887.

Answer. 1. Wire is wound with two layers of cotton yarn. After winding on the magnets, shellac in alcohol is used, and well dried. Wood alcohol is not fit for this purpose, as it contains too much water. 2. No; the "extra" current, at time of breaking, is in the *same* direction. 3. Yes; the former requires an induction coil. Both are hardly practicable for you.

OUR CHICAGO LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

"Behold! how good and how pleasant it is for brethren to dwell together in unity," and all that sort of sentiment, belongs away back in the times of Solomon and the Queen of Sheba, and a few other ladies who never saw a street car or an incandescent lamp. That kind of "pretty talk" has no influence in these days of electricity and grasping fingers.

For instance, not very long ago, an inventor in Chicago brought out an ingenious combination of hatchways and thermostats, so arranged that a slight addition to the temperature of the building would fire the triggers, and down would go all the elevator hatchways with a slam, and cut off the draft which usually proves so destructive in case of fire. Of course, as soon as it was thought that there was a dollar or two at the bottom, why—— To-day there are two companies, each of whom anticipates the utter annihilation of the other in the coming legal contest Both are in the patent office, and each will claim to be the original Doctor Jacob.

St. Catherines, Ont., has a street franchise, and the company has just opened an electrical railway between St. Catherines, Thorold and Merritton. The Van Depoele system is used, and the power is generated at lock 12, by water. The generator is of one hundred horse power capacity, and six motor cars are doing the work with the happiest results.

Memory is jogged by the above, and goes back to a dark night in December, 1846, when a thin, shad-shaped youth, a telegraph operator, rode in an open mail wagon called a stage, from Hamilton to Grimsby, in a rain, without an overcoat; and from Grimsby to St. Catherines in an open wagon, in moonlight and a freezing atmosphere. A half-frozen youth, at daylight, was carried into the hotel at St. Catherines, by the good, bluff old landlord, who saw to it personally that the boy operator was well loaded with rum and honey, and well stowed between blankets, to sweat out the cold He thawed out after awhile, to thank the salvage corps in an undertone, but the memory of that good old red-nosed boniface will remain with the writer while time is for him. It was a very cold night, and it was an old-fashioned drunk—but the boy lived. Operators were considered somebody in those old days.

The Illinois State board of equalization was in session last week. The following are some of the assessment valuations as reported by the committee: Chicago Telephone Co., $275,000; Central Union, $389 817.

The Peoria Heat, Light and Power Co. of Peoria, Ill., was incorporated a few days since; object, to heat by steam and light by electricity. Capital, $50,000; Jos. B. Smith, Elliott Callender, S. H. Thompson and R. T. McDonald, incorporators.

The day of Juba-Lee or some other Juba is here, and the dancing of the outside telephone companies has commenced, to the patting of the Bell Company. On the 11th the Bell folks secured an order from Judge Brewer in the U S. Court in Missouri, restraining the Pan Telephone Company from putting up or using electric telephones. Philip L. Rose and others, defendants, are the parties composing the firm of Rose & Reise, the manufacturers of instruments for the Pan-Electric Company.

The coming day of municipal electric lighting in Chicago is breaking through the rift. As a steamboat runner once said relative to a delayed boat, "She's almost in sight!"

The opening wedge was the order for lighting the rivers by arc lamps. The way for that was paved by the City Hall plant of glow lamps, and the illumination of Rush, Lake and Twelfth streets' bridges. These were a sort of kindergarten object lessons for the people, to show up electric lighting. Then came the river lights proposition. It fluttered and hung fire, but eventually prevailed. By December 1st the venerable electrician over in the City Hall tells the newspaper representatives they will be able to sit at night on the fragrant banks of the beautiful river which divides the city of Chicago into three portions, and see the vessels go by, illuminated by the electric lights belonging to the city.

The monster chimney is finished, and the engine foundations are now going in. The lines are being very rapidly placed, and before hardly anyone is really aware of it, the illumination will begin.

Now, this having been placed beyond peradventure, the various aldermen are talking over the future of electricity here, and are getting data together on the subject. The gas trust business has grown to be such a "monopoly of nuisances" that it is no longer a question if the city is not being very badly worsted at every turn by these companies. The city has granted them every reasonable right, until "they have, in a measure, a quit claim to the city, and a past due mortgage on the entire county." as a prominent politician remarked the other day. The city has made some progress in breaking the bonds, and as the City Clerk said the other day, "It [electric lighting] is the only way out of this trouble. It solves this gas problem so far as the city is concerned, and it is the only thing that will. There is no use in talking; the city should own and control its own system for supplying light, the same as water, and not be at the mercy of any gas monopoly. The interest manifested by many Aldermen proves that they think the same thing." Yesterday Alderman Gile talked with Mr. Barrett to see if he couldn't offer some solution of the problem. The Professor gave the Alderman some facts and figures. Alderman Kerr also favors the electric light system, as do Clarke, Hamline, Wetherell, Manierre, and many others. To give the Aldermen more accurate information Mr. Barrett is having careful estimates made for all parts of the city, and will soon be able to tell the Council just what electricity will cost and what it can do.

Alderman Wetherell, chairman of the finance committee of the Council, and Prof. Barrett have been much closeted on this subject, of late, and the Professor thinks, from what he has chalked out, that electricity would readily furnish better light, and more of it, for not over 60 per cent of what light now costs, and when the plant now in course of construction is completed and running, there is no doubt something more tangible than mere talk and guess work will be undertaken.

When the thermometer pulls its mercury down below the zero mark, and the little bilious street light undertakes to argue the point with an electric flash, then is a good time for the councilmen to examine the gas and electric light bills by the aid of a photometer. There is no case on record, so far found, where the freezing up of gas pipes made any difference with the grand total of the cost, and even a meter has been severed from a city building without in the least affecting the monthly claim—if the meter don't register, why the "general average" does and the

"Consumption —— feet at ——"

turns up as regular as a hired man at supper time.

The Chicago Electric Club is not doing anything by halves. The committee on furnishing the rooms is decidedly a go-ahead committee. It is promised that the meeting to-night shall be held in a completely fitted and furnished suite of rooms. Buckley, Shain and Stiles make a glorious trinity for the work.

Mr. E. P. Warner will dedicate the rooms by reading the first paper, which was postponed on account of absence from the city.

The main hall, twenty by fifty-seven feet, is divided by portieres, making three very comfortable and convenient rooms, the Clark street front being the parlor—the middle room a library, and the third a smoking room. Still back of this a smaller room some twenty feet square, perhaps, has been arranged for a dining-room. It is the intention of a large number of the members to take their daily lunch here. The three rooms first mentioned, on regular meeting evenings, or on the occasion of general gatherings of whatever nature, will be thrown into one. The rooms

é located a story and a half above the walk, so that while they are on the second floor, they are in reality only one flight and a half up. To be accurate, thirty-four steps from the street.

Another chapter in the Chicago-and-New-York-simultaneously-published-romance, entitled "Down with the Bucket Shops, or, the Devil is in it," has just made its appearance. The sub-heading for the chapter is: "Out goes the Commercial Quotation Company." The C. Q. C. is charged with being naughty and disloyal, and furnishing the enemy with information on which to gamble, and the B. of T.—that's the regulars, say that the Bucket Shops—that's the irregulars, shall not have it. The upshot of the thing is that the B. of. T.—that's the regulars, will probably buy out the Quotation Company—that's the irregulars' agent. The B of T. say that they can buy a plant that cost $40,000. for $5,000, and who ever knew a B. of T. that wasn't ready to buy anything for a York shilling on the dollar?

The cupidity of humanity is always driving some fellow to work harder to obtain a dishonest living than would enable the same chap to thrive in an honorable manner. The remark applies with force to that class of chevaliers of industry who cut and carry off electric light wires for the lead there is around them. Not long ago, some columns in the extension part of the Western Electric Company's building, during the night were overturned, and the thin sheet of lead on which they stood, stolen. This was comparatively safe, but by and by, some fellow will hit a line circuit, and pay a bigger price for a few feet of lead cable than will make the transaction profitable.

The telegraph shuffle has commenced, and the B. & O. boys, both operators and messengers, are expecting their last pay and last general muster in a day or so. Some, of course, will be retained, but the majority will be permitted to retire. Prices of telegrams will advance, and there will be the usual amount of swearing in consequence, but the world will continue to do business at the some old stand as heretofore, with the same popular assistants and appliances; but it will be inconvenient, all the same, to pay two or three times as much of one's small change as now, for a mutilated message to some competing point, and get no satisfaction when one inquires for the missing or mangled word.

CHICAGO, Oct. 17, 1887.

OUR BOSTON LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

The question of lighting Hyde Park by the electric light is still open. The contract will probably be let soon, but all rumors that it had been granted prove to be unfounded.

There are a number of interesting exhibits at the Mechanics' Fair, which is meeting with fine success.

The Tewksbury Almshouse, which is the State Almshouse of Massachusetts, has ordered a five hundred light Mather plant incandescent, of Claflin & Kimball, the N. E. agents. The plan, specifications and sale were made by Thos. Pray, Jr., who closed his engagement with the Mather Company's agents on Saturday, Oct. 15, 1887.

The Electric Gas Lighting Company have, at the Mechanics' Fair, a unique exhibit which is attracting great attention. In a little building shingled with Victor bells are collected all the appliances for gas lighting. The youthful of all ages delight to ring the bells and gongs to light and extinguish the automatic burners. When a half dozen of street automatics light in succession there is considerable enthusiasm on the part of the spectators. Several automatics and pull-down burners have been lighted and extinguished over 20 000 times each, and as they are in this exhibit are used as much in a day as they would in a residence in a year. Next to this building is an open space, in which the batteries, bells, buttons, keys, cut-outs, wire, etc., manufactured and handled by the company are displayed. The Star electro-mechanical gong is an attraction within hearing distance. A 50-drop gravity, of tasty finish, is much admired by hotel men.

BOSTON, Oct. 18.

Shocks From Alternating Currents.

BY G. L. ADDENBROOKE.

This subject, which has always been an interesting one physiologically, has now become a question of daily increasing commercial importance, owing to the tendency to use higher and higher voltages in electric lighting and the transmission of power, and to the success which has attended the employment of transformers in connection with alternating current dynamos for lighting both here, in America, and on the Continent.

Statements, more or less positive on the subject, are current in the text books, have been and are being made constantly by various authorities, and we have in addition more or less satisfactory accounts of shocks which have been received by various persons, and, lastly, the records of accidents, including some fatal ones, which have happened owing to the action of the current.

It is with a view of adding, if possible, to the general experiences in this matter, and with a desire to clear up some misconceptions, that I propose to take up my parable.

In answer to the natural inquiry, what qualifications or experience I possess, entitling me to speak on this subject, I may state that besides the experience and knowledge I have gained from other sources, I am acquainted with nearly all that has been done at the large installation at the Grosvenor Gallery from the first, and further, that from the beginning of last November to the end of July, I was, amongst other things, responsible for the whole of the circuits and the installation in private houses, public buildings, etc., supplied from this center. These installations amounted to about 60 in number, and are supplied by four separate circuits, extending over an area of, perhaps, a couple of square miles, while the two extreme opposite points are distant nearly a mile and a half from one another.

Now, as is already known in the scientific world, the tension of the main or primary current which has proceeded from the engine room at the Grosvenor for the last year is 2,500 volts alternating.

In dealing commercially with a current of this intensity, and of a quality sometimes sufficient to incandesce over 2,000 lamps at one time—of course there are very many more than this number of lamps on the circuit—it may readily be conceived that phenomena are met with, and effects seen and producible at will, which so far it has not fallen within the province of the majority of electrical engineers to experience or observe.

In what I am about to say, I propose to limit myself to the effects of the current on the human body under circumstances likely to arise in carrying out work in connection with such circuits.

And firstly, I would remark that when everything is in parallel, as at the Grosvenor, the risk of anyone interposing himself directly in the circuit, as has happened in series working, or of anyone laying hold of both mains at once, and so forming a bridge across the circuit, seems very slight indeed. At any rate, no such accident has so far happened, and even if one should happen, I am by no means prepared to assert that the result would undoubtedly be fatal; indeed, I rather incline to the opinion that if the subject of the shock were healthy, and the circumstances under which he received it were favorable, the chances are he would survive. He would, I think, have about as good a chance of life as a man who brought a naked light near the orifice of a 3 or 4-inch gas main with the pressure on, a mishap which has occurred before now.

The class of shocks generally met with in practice and to be dealt with here, are those caused by touching a main directly, or some more or less conductive substance in contact with a main, a current passing owing to the difference of potential set up either through a defect in some other portion of the mains or to a general leakage over the system. And here it may be parenthetically remarked that with mains extending for many miles with numerous branches, terminated by cut-outs, switches and transformers, however high the specific insulation of any given section or piece of apparatus may be, yet, taking the whole circuit—at any rate, in damp and foggy weather—the actual insulation cannot be other than only moderate, diminishing with the extension of the circuits.

It will be readily granted by engineers that in central station working, however great the care and provision of the engineers in charge, occasional shocks must be experienced, owing to carelessness or thoughtlessness of workman, inadvertence, and other causes.

The writer himself received one, which was reported in this paper (though without his previous knowledge), not exactly as it happened, but still with sufficient correctness for the end now in view.

The primary effect of the passage of the current through the body is, of course, to contract the muscles. The amount and persistence of this contraction depend on the quantity of current flowing, or, as it is usually designated, "the intensity of the shock," and varies from a simple twitching of the limbs to complete and intense contraction or rigor of apparently every muscle in the body. In this latter case, the current completely supersedes the action of the mind over everything capable of contraction or movement. Consciousness, however, is apparently rarely, if ever, lost, though the "subject" may be entirely unable to make any motion, cry out, or do anything to help himself. If aid is not near, such a state may be maintained for some time. On release from such a position by extraneous aid or natural causes, the subject is usually dazed, but if at all unconscious, soon recovers completely, and experiences no further functional disturbance than the debility and nervousness naturally following such a severe strain on the system.

About three months ago a man working under me, while making some alterations to a customer's branch on a pole, received such a severe shock as I have described above, and, moreover, partly in consequence of it and partly through the stupidity of another workman, who quite lost his head while trying to extricate his mate, they both afterwards fell a considerable distance on to and through a tiled roof. A broken tile gave the one who had received the shock a very severe cut some inches long on the back of the head and naturally he was also much bruised and shaken by his fall. He was taken to the Middlesex Hospital, his wounds dressed, and put to bed. Besides the scalp wound he had a bad burn between the thumb and fore finger of the left hand, as if a red hot poker had been laid on the spot and allowed to remain a second or two before being taken away. I detailed all the circumstances to the house surgeon, who kindly undertook to examine the man carefully to see if his nervous system was at all affected. Nothing abnormal, however, could be discovered about the heart's action, nor were there any other secondary symptoms. The cut healed rapidly and naturally, the man was out of the hospital in a few days, and soon went off to the seaside to recover his somewhat disturbed equanimity.

I could give details of two or three other cases in which even severer shocks have been received than this one, but the results electrically were much the same as in the above instance.

No doubt a strong enough current can be passed through the body to cause death; deaths have happened in this way; but if the shock is not sufficient to cause instantaneous collapse, apparently the body can bear the strain of the continued passage of the current for some time. How long will, of course, depend on circumstances; but I think there is enough evidence to show that death, if it resulted, would not be due directly to the effects of the current, but to the paralysis of the involuntary muscles controlling the action of the lungs and heart, caused while it lasted. For as there is no doubt that the current causes intense contraction of all the voluntary muscles, so it does not appear why there should be any exception in the case of the involuntary ones.

Edison's Phonograph.

THE INVENTOR'S LOT IS NOT A HAPPY ONE —POSSIBILITY OF A LAW SUIT.

A gentleman connected with the patent interests of Mr. Edison was asked yesterday whether it was true that the inventor had perfected his phonograph.

"He has been improving the instrument for some time," was the reply, "and is almost ready to go upon the market with a machine that will meet all practical requirements. But have you heard about the graphophone fuss?" inquired the gentleman.

The *Star's* representative was obliged to admit that he was not familiar with the subject, and forthwith expanded his ears in order to take it all in.

"For some time past," said the informant, "a company called the Graphophone Company, with headquarters at Washington, D. C., have been bringing to the attention of the public a machine similar in design and purpose to the Edison phonograph. They call it the graphophone; which word, as you see, is simply *phonograph* backward, so to speak. They are working under patents granted to C. S. Tainter and Alexander G. Bell. The machine has been on exhibition in Washington and elsewhere; and, upon the representation that a working arrangement was about to be made with Edison, granting them license to manufacture, a large amount of stock has been sold. The Graphophone patent company was stocked at $50.000, the par value of stock being $25 per share. As high as $500 has been offered for shares in this company. The American Graphophone Company started out with a capitalization of $600,000, the par value of stock being $10. This stock is now rated at $28 per share, and arrangements have been made to pool this stock and hold it at $45. The American company was to work under license of the parent company. The first question naturally asked by investors was: How about Edison; what arrangement has been made with him? Upon representation that that part of the matter was all right, the stock has reached a high figure. Considerable stock was also given to newspaper men at a special rate, considerably below par; while the public could only come in at par. It now transpires that they have never been able to make arrangements with Mr. Edison, and that he flatly refused to enter into negotiations. Mr. Edison's phonograph company is already formed, the necessary contracts are drawn up, and a factory has been established. In an English patent, No. 1,644, Mr. Edison describes his invention, and practically covers the so-called graphophone at every point. The wax cylinder, which is looked upon as the solution of the whole matter by the graphophone interests, is described in this patent, as are nearly all the details of their machine."

"May not a consolidation of the two interests be effected?"

"No, indeed; and Mr. Edison will promply begin suit as soon as one of the Taintor Bell instruments is put on the market."

"Who are the parties connected with the graphopbone syndicate?"

"James H. Saville, J. H. White, Andrew Divine and James H. Clephane; and it is understood that they have pocketed large profits upon the representations made concerning the Edison inventions."—*N. Y. Star, Oct.* 15.

Electrician Weston on Electric Railroads.

"I have solved the question of travel by electricity," remarked Mr. Edward Weston to a *Herald* reporter this week, "and I am now building an experimental motor. There will, of course, be improvements in devices, but there is nothing further to be done in principle. That is complete and leaves no question that we can travel between New York and Philadelphia, drawn by an electric motor as rapidly and safely as by steam power, and more cheaply. There is no guesswork about my assertion. It is so certain that I stake my professional reputation on having the trains running as soon as the patents are granted, the roads ready to make the experiments and the motors built. Of course, I cannot now make public the principle, but I may say that it differs from any of the existing methods of operating electric motors on railway lines. It is not merely a scientific possibility, but a practical, commercially available and economical solution of the problem of electric railway motors."

Telephonic News

*** Since living in the South, Mr. Frank B. Knight has become quite an accomplished French linguist, and can "parley fransay" with the oldest French settler.

*** The New England Telephone Company has been granted permission to erect sixteen more poles in the city of Boston. This does not look like underground work.

*** Efforts are being made to introduce the Bonta Telephone in Rochester. Only a few of the Bell instruments are used in that city, consequently the city is almost entirely without telephone service.

*** Mexico possesses more than 20,000 miles of telegraphic lines, besides the telephonic. It will be seen that a large amount of material is required for the filling up of the lines and offices. In providing such materials England seems to have a very small share, the greater quantity being obtained from the United States.

*** The German administration of telegraphs, finding that the telephonic line between Berlin and Hamburg suffers from too much traffic, has reduced the duration of each conversation from five to three minutes, the price remaining the same. This measure has called forth some very lively remarks from the public, who were accustomed to use this telephonic communication.

*** The old time bell-rope, which for years has adorned the ceiling of all cars, is to be supplanted by a concealed wire connected with push buttons, inside and outside the car, only a touch being needed to give the signal. Should a coupling break, the electric connection is severed, and the gong in the cab warns the engineer of the fact. A test apparatus has been made on an Erie passenger train, and it has been found to work perfectly.

*** The first Bell telephone line actually built for the purpose was finished about April 4, 1887, and extended between the office of Mr. Chas. Williams, jr., at 109 Court street, Boston, and his house at Somerville, Mass. The first commercial telephone exchange was opened at New Haven, Conn., January 28th, 1878, under the direction of Mr. Geo. W. Coy. On February 14 Mr. E. B. Baker opened a similar exchange at Meriden, Conn.

*** All the trains on the Lehigh Valley between New York and Easton are now equipped with apparatus for telegraphing while in motion. The operator's office is in the baggage-car, where is also the apparatus for carrying the current by induction to the wires along the road. Western Union rates and ten cents additional will be charged for this service. The system will be put in operation over the entire Lehigh Valley line, and other railways are negotiating with the Consolidated Company for the adoption of the induction system.

*** Judge Thayer, of the United States Circuit Court, at St. Louis last week, in the case of the American Bell Telephone Company against Philip L. Rose *et al*, issued an order restraining the defendants from directly or indirectly making, using, selling or furnishing to others electric speaking telephones or telephonic apparatus embracing or embodying the inventions and improvements of patents granted to Alexander Graham Bell. The defendants are summoned to appear in the Circuit Court Saturday next to argue the motion for temporary injunction. This legal step by the Bell Company is more important than appears on the surface. The Philip L. Rose *et al* are Rose & Rein of that city, who make instruments for the Pan-Electric Company, hence the action is indirectly aimed at that concern.

*** A dispatch from Indianapolis says: The American Bell Telephone Company is having a great deal of trouble protecting its business in Indiana. Since the passage of an act three years ago limiting the rental charges for telephone service to $3 per month, the Bell Company has been operating on a toll system, charging five cents for each connection made. The service has been unsatisfactory and the municipal governments of several cities have revoked the charter permitting the company to use their streets for its poles and wires. In South Bend after the company had removed its instruments the council ordered the poles to be cut away by the city officials, and, although this was temporarily enjoined, a ruling of court was had favorable to the city and it was persisted in. The Cushman telephone has been brought into use at South Bend, Laporte, Michigan City, Elkhart, Logansport and other cities, and the Bell Company has filed in the United States Court here several hundred suits against persons patronizing the Cushman Company and demanding damages and an injunction in each case.

*** At St. Louis, October 10, Judge Thayer, of the United States Court, in the case of the American Bell Telephone Company against Phillip L. Rose et al, issued an order restraining the defendants from directly or indirectly making, using, selling, or furnishing to others electric-speaking telephones or telephonic apparatus embracing or embodying the inventions and improvements of patents granted to Alexander Graham Bell. The defendants are summoned to appear in the Circuit Court Saturday next to argue a motion for a temporary injunction. This legal step by the Bell Company is more important than it appears on the surface. The Phillip L. Rose et al are Rose & Rein, of St. Louis, who make instruments for the Pan-Electric Company. Hence the action indirectly aimed at that concern.

*** If we are to believe an Austrian paper, says *La Lumière Electrique*, the first lightning conductor was not constructed by Franklin, but by a monk of Seuftenberg, in Bohemia, named Prohop Diwisch, who installed an apparatus the 15th of June, 1754, in the garden of the curate of Prenditz (Moravia). The apparatus was composed of a pole surmounted by an iron rod supporting twelve curved up branches, and terminating in as many metallic boxes, filled with iron ore and closed by a boxwood cover, traversed by 27 sharp iron points, which plunged at their base in the ore. All the system was united to the earth by a large chain. The enemies of Diwisch, jealous of his success at the court of Vienna, excited the peasants of the locality against him, and under the pretext that his lightning rod was the cause of the great drought, they made him take down the erection which he had utilized for six years.

*** The toll patrons of the telephone line in St. Louis do not pay a fixed subscription to the company, but merely the sum of five cents for each communication. The collection of this sum is effected automatically by the apparatus itself. Above the transmitter there is a box containing a slit in the upper part. When the subscriber wishes to communicate with any one, he places a five-cent piece in the slit, and takes the receiver from its hook. The coin, in sliding, closes a circuit, a call is made at the central office, and the subscriber can talk as much as he pleases, either with the officer or another subscriber. When the conversation is finished, he has only to hang up the receiver, in order to give an automatic signal to break the communication, and the coin falls into a box, whose key is carried by the company's collector. If the person with whom the subscriber wishes to speak is already in communication, the employe of the central office informs him of the fact by means of a contact upon which he presses, and which sets a mechanism in operation that drives the coin to the side of the box; and when the subscriber hangs up his receiver, the money is returned to him. More than two hundred of these apparatuses are now in operation in St. Louis, and giving very good results.

*** The Electrical Committee of Councils, on Wednesday referred to a sub-committee an ordinance to grant permission to the Morse Underground Electric Company to lay a conduit on Delaware avenue, from Walnut street to Arch, in Philadelphia. The ordinance met with opposition from the members of the committee, because the company had neglected to take advantage of other privileges. Mr. A. Ellwood Jones said the company had been in the hands of speculators, and that privileges were sought for the purpose of selling stock. President Mershon, of the Morse Company, admitted that the concern had been run by speculators, but claimed that such was not the case at present. An ordinance, granting permission to the National Automatic Fire Alarm Company to place its instruments in the office of the Electrical Bureau, failed to receive the approval of the committee.

The Ireson Leather Link Belting for Electric Purposes.

Electrical motors and dynamos exact from the belting with which they are connected, either with their work or their source of power, more than any other belted machinery, the qualities of flexibility, strength and lack of elasticity. The pulleys upon the dynamo or motor are always small, and the belt runs to or from these small pulleys very much more rapidly than in ordinary machinery, because the speed of the dynamo or motor is much higher than the speed of almost every other kind of belted machine, excepting the very rapid machines which are used in light wood working. In consequence of this the belt runs with very considerable rapidity, and takes very short turns; it must, therefore, be more than ordinarily flexible transversely of its length.

This quality of flexibility transversely of its length is readily given by dividing the belt into short links which are jointed together at a distance of about an inch between the joints; and these links being made about as wide as the thickness of a double or a treble belt, are practically as strong as the two or three thicknesses of leather which they represent; and while they are almost perfectly rigid each by itself, when strung upon the wires which make the hinge joints transversely of the run of the belt, they make a belt much more flexible transversely of its length than it would be possible for a double riveted or cemented belt to be, or even than a heavy single belt. Hence very little power in such a belt as this is wasted in bending the belt around the pulley.

Such a link belt as has been described would, however, require a form of pulley unusual in this country, and generally considered a disadvantageous form, namely, a pulley without a crowning periphery, and with lateral flanges to keep the belt from running off. This disadvantage of link belting prevented it from being adopted on machinery generally until extraordinarily strong and extraordinarily flexible belts became essential conditions for the introduction of the electric generator and motor, with due regard to economy. The flanged edge pulley is considered particularly disadvantageous in quick running machinery because of the constant liability to edge friction between the belt and the flange, and hence it has become, within a few years, essential to adapt the leather link belt to the crowning pulley, so that it shall

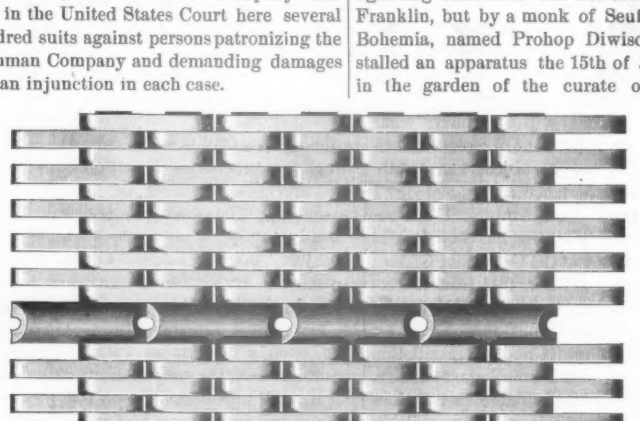
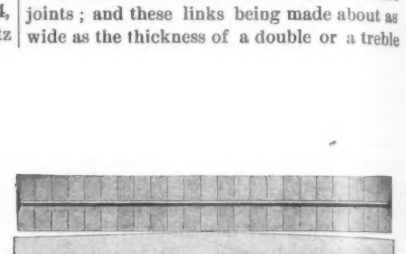


FIG. 1.—SECTION OF THE IRESON SELF-ADJUSTING LEATHER LINK BELT.



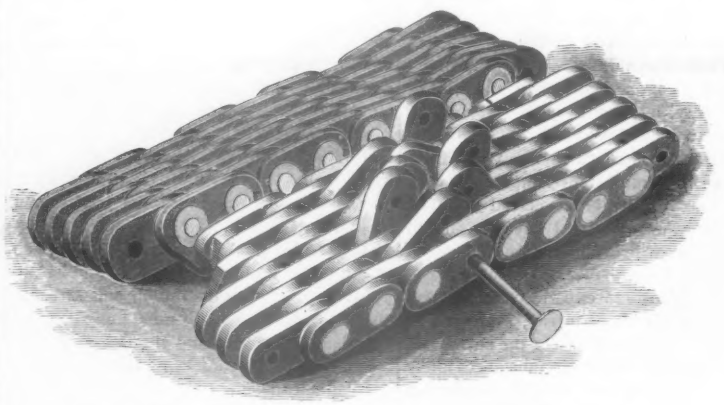
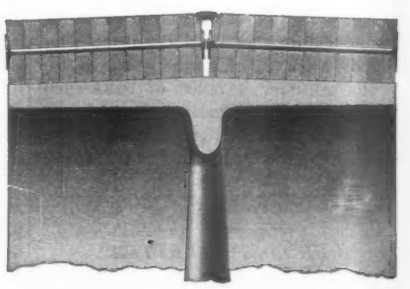


FIG. 2.—METHOD OF MAKING BELT ENDLESS—BOTTOM SURFACE UP.



FIGS. 3 AND 4.—ILLUSTRATING ADVANTAGE OF FLEXIBLE CENTER OF IRESON BELT.

constantly center itself upon the pulley in running, as the ordinary belting centers itself. This result of adapting the link belt to a crowning pulley was accomplished by Messrs. James Lee & Sons, of Hipperholme, Halifax, England, about three years ago, and was patented in this country and in England. The device by which the result is accomplished is like most devices which exercise an important influence in the arts, exceedingly simple, and consists in making the belting in two or more longitudinal sections which are hinged together by their edges. If made in two sections the hinge rides over the crown of an ordinary cone crowned pulley. If, however, a round faced pulley be used, or the belt is of great width, it is usually better to make the belting in more than two sections, and give it more than one set of longitudinal hinges. By thus furnishing the belting with a series of longitudinal hinges the belt adapts itself to the crown of the pulley just exactly as an ordinary belt adapts itself to the crown of the pulley.

Charles L. Ireson, No. 97 High st., Boston, has patented a belt of this form, and one made by him was seen at the meeting of the National Electric Light Association, in Boston, August 8, 9 and 10, 1887. A Baxter six horse motor delivered with a three-inch link belt its power to a counter-shaft, from which counter shaft two four-inch common belts delivered the power to the shaft of a No. 6 Sturtevant blower, rated as requiring six horse power. The link belt was so slack on the following side that in running from a five-inch pulley to a twenty-four-inch pulley, which were set about eight feet apart on the centers, there was a sag of about ten inches from the straight line which would have joined the highest points in the crown surface of the pulleys, the sag of the belt bringing the lower part of it within four inches of the hauling side of the belt. In consequence of this sag the lap of the belt on the small pulley was more than a semi-circumference, while with ordinary belting this lap would have been somewhere from a quarter to a third of the circumference. As a result of this there was no slip, and a much narrower belt could be used than if frictional contact between the belt and the pulley had been required to be made by the width of the belt instead of by the length of the belt.

It was at first thought that these belts would be useful only on slow running machines, but experience has shown that they are far more desirable on machinery that runs at high velocity. The links must be made from the very best of belt leather in order to have them all of practically uniform quality. Every attempt to use shoemakers' stock or inferior parts of belt leather has shown that a thoroughly reliable belt cannot be obtained, if this economy in material is practiced. As a result these belts are necessarily of high cost, but the experience which has been had with them in England indicates that their durability is considerably greater.

It is obvious that the interstices of this belt prevent absolutely the formation of "air-cushion" between the belt and pulley, and secure thereby perfect belt contact. The diminished tension employed is a great relief to the bearings of the machinery, and also lessens the destructive strains on the belt, allowing all parts of the belt to rest when they are on the following side. The greater comparative weight of this belt causes it to act as a fly-wheel or regulator of the machinery and thus gives greater steadiness to the work. In consequence of the diminished tension allowable with this belt it does not require readjustment when the leather is affected by dampness or heat, as it practically takes up its own slack and accumulates it all on the following side of the belt.

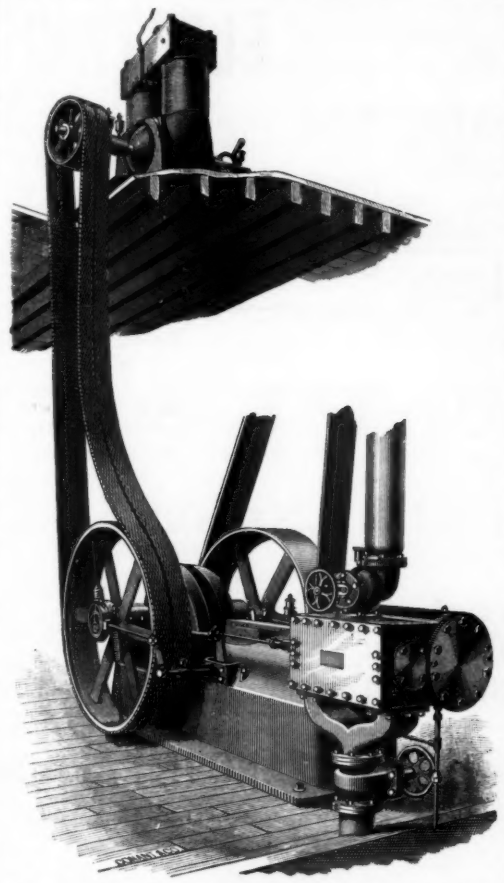


FIG. 5.—VIEW OF VERTICAL BELT IN USE AT EDISON STATION, HEAD PLACE, BOSTON.

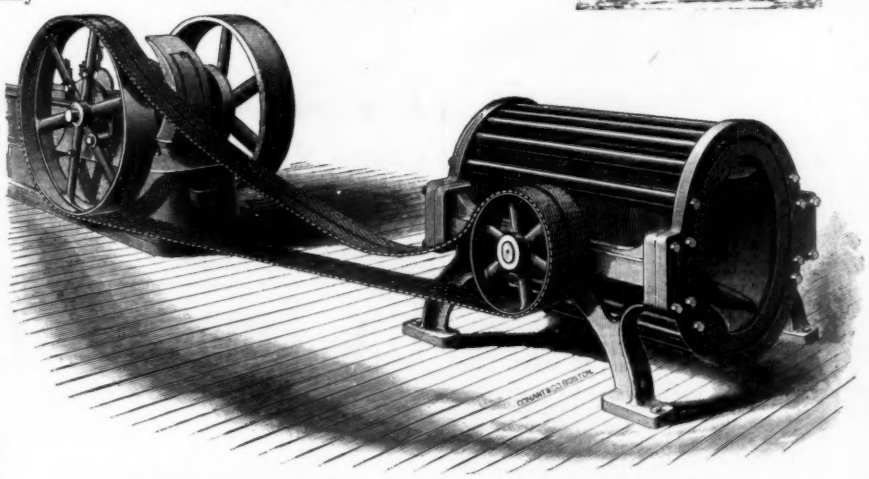


FIG. 6.—IRESON'S BELT IN USE AT BOSTON ELECTRIC LIGHT COMPANY'S STATION.

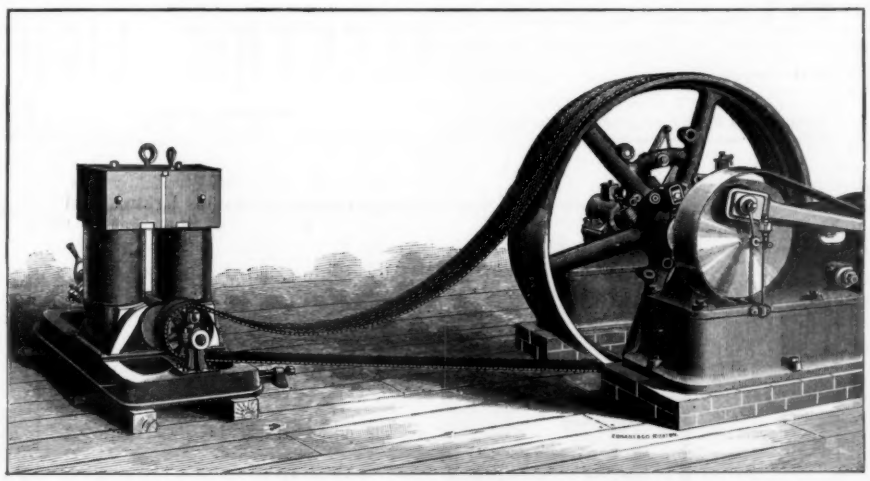


FIG. 7.—WEYMOUTH, MASS., ELECTRIC LIGHT PLANT (BRADLEY FERTILIZER CO.) RUN BY IRESON'S BELT.

Electric Light on Russian Railways.

The Russian Minister of Ways of Communication has appointed a special commission to select the best system of electric lighting for railway carriages. This is the result of a decision recently arrived at to render the adoption of the electric light compulsory upon the principal railway companies for all passenger trains. The experiments will be conducted on the Nicolaeff Railway, and are not expected to last more than a month. The South Russian Railway Company, it should be noted, has already adopted the electric light for all fast trains running between Odessa and Kieff; while it has been used in the special Imperial trains for some time past.

—— The Massachusetts Gas Commissioners have issued an order authorizing the Brookline Gas Light Company to furnish electricity for lighting purposes and power in Brighton wherever the company has authority to furnish gas, and in Brookline, and also in so much of Boston as was formerly in the town of Brookline. It requires that the company shall construct and equip within six months from date, a plant with a minimum capacity of 180 arc lamps of nominally 1,200 candle power; 100 arc lamps of nominally 2,000 candle power, and 300 incandescent lamps of nominally 16 candle power.

——The comptroller of the city of Buffalo, N. Y., in response to a request from the council, reported that there was no data in his office from which the number of miles of streets in the city lighted with electricity could be determined. The city engineer informed him that there are about 14¼ miles lighted with 6,812 gas lamps, and 45½ miles with electric lamps. The cost of gas, including the lighting and extinguishing and repairing, is $23.40 per annum per lamp, or $159,400.80, which is $1,124.52 per mile per annum. The electric lamps cost $182.50 per lamp, or $115,157.50 per annum. Referred to the committee on lamps.

—— An item is going the rounds of the press to the effect that Edison is going to California for the purpose of conducting experiments in electro-metallurgy. Two years ago Dr. J. H. Rae of San Francisco recovered gold from the black sands on the beach below the Cliff House, and is now building a small electric plant to test it practically and for its commercial value. Many of Dr. Rae's electrical experiments and patents for obtaining the precious metals by the means of electricity date back to 1867, when the first patent issued for electro-metallurgy was issued to him.

ELECTRIC LIGHT NEWS

—— The Shultz Belting Co. of St. Louis, Mo., have just put in a new power belt press 62 inches wide, and can now make patent frilled leather belts five feet wide.

—— The Underground Electric Conduit and Water Pipe Company, of Denver, is putting down an extensive system of conduits for the electric light company of that city.

—— Every theater should be lighted throughout by electricity, and no gas lights should be allowed either on the stage, or under it, or in the auditorium.—*New York Sun.*

—— Although it is less than a year and a half since the American system, as now constituted, was first introduced by the American Company, it is said there are over 10,000 arc lights of their manufacture in daily operation. It is thought by the officers of the American Company that their output during the present year will exceed 15,000.

—— The Peninsula Electric Light and Power Company, Houghton, Mich., was incorporated October 1st, 1887, with a capital stock of $50,000. The officers are Jay A. Hubbell, president; James B. Sturgis, secretary and treasurer; James R. Dee, general manager. The company was originally the James R. Dee Electric Illuminating Company, which was started last April. The company operates the Thomson-Houston system.

—— A number of gentlemen representing the Brush Electric Light Company, says a Baltimore exchange, called at the City Hall and urged Mayor Hodges to sign the electric light ordinance passed at the recent session of the City Council. Mayor Hodges answered that he had not yet given the matter a thought nor will he take it up until he has had an opportunity to consult with City Register Robb, Comptroller Horner and City Solicitor Carter about it. The Mayor said there were several legal points involved on which he wanted to be fully informed, and he would not proceed hastily to dispose of the contract.

—— The Schuyler Electric Company will in two weeks begin operations in its new quarters at Middletown, the final arrangements having been completed. The company has been unable to secure suitable factory accommodations in Hartford since the sale of the Engineering Company's buildings. Middletown offered inducements by not only furnishing a large factory, but by the people of that city subscribing for $50,000 of stock. The company will occupy the Victor Sewing Machine Factory, on Hamilton street, which has been vacant for some time past. The buildings are of brick and well adapted to the needs of the company, being of sufficient size to accommodate 1,000 men. Nearly all of the employes of the company will remove to Middletown, and 400 men will be immediately employed.

—— Mr. Jeff Tiernan, of Galveston, Texas, has in his possession a bean that overreaches other beans by several degrees. Sheriff Tiernan brought it from San Francisco, and presented it to Mr. Jeff Tiernan. A portion of it has been cut off to make it slightly lop sided, but that does not act as a hindrance to its eccentric movement. When deposited in the palm of the hand or on a table, or in fact anywhere, it hops and skips about with as much animation as though really containing a vital spark. It remains perfectly motionless at first, and then suddenly makes a bound of 2 or 3 inches, varying its movements occasionally by crawling along on its flat side and wriggling like an eel. It is certainly a phenomenon, and there appears to be no plausible theory on which to base an explanation. It is thought by some that the touch of the fingers imparts electricity to the bean, which throbs violently when held in the hand.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING OCT. 11, 1887.

371,161 Insulating clamp for electric conductors; Thomas E. Adams, Cleveland, Ohio.

371,199 Electric spinning or twisting machine; Alonzo S. Kimball and George L. Brownell, Worcester, Mass.

371,202 Electric wire conduit; John Lynch, Washington, D. C.

371,241 Telephone system and apparatus; Granville T. Woods, Cincinnati, Ohio, assignor to the Woods Electric Company.

371,244 Primary battery; Mark Bailey and John Warner, London, England.

371,253 Electric locomotion; Leo Daft, Plainfield, N. J.

371,260 Telephone switch; Wm. M. Goodridge, Highland Park, assignor to the Western Electric Company, Chicago, Ill.

371,331 Apparatus for the transmission of electrical energy; Gustav Kornmuller, Ghent, Belgium.

371,336 Means for supporting overhead conductors; George W. Mansfield, Cleveland, Ohio.

371,358 Secondary battery; Anthony Reckenzaun, London, county of Essex, England.

371,466 Plastic composition for insulating electric wires, etc.; Wesley W. Barnes, New York, assignor to Benjamin C. Kirk and Thomas T. Tabor, both of Glen Cove, and Walsingham A. Miller.

371,436 Method of and apparatus for starting electric motors; Leo Daft, Plainfield, N. J.

371,443 Reversing mechanism for electric motors; Frank E. Fisher, Detroit, Mich.

371,445 Electric Signaling apparatus; William Glasgow and Samuel S. Stevens, Chicago, Ill., assignors to the Combined Electric and Trip Bell Cord Company.

371,521 Galvanic ring; Horace N. Rowell, Boston, Mass., assignor of one-half to John W. Duxbury, same place.

371,524 Induction coil; Elias Smith, Peoria, Ill.; assignor of one-half to Fred. Kimble, same place.

371,531 Method of operating with electrical conductors; John E. Watson, Louisville, Ky., assignor to the International Electrical Company, same place.

PATENTS.

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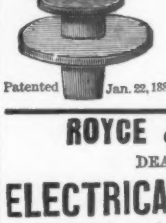

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Brush Electric Co., Alex. Kempt, Special Agent.
Excelsior Electric Co., C. J. Reilly, Western Mgr.
Sperry Electric Light Motor & Car Brake Co., 201 Royal Insurance Building.
J. H. Reid, General Manager of the Mather Electric Light Co., Chicago.
Wm. H. Purdey, Comm. of Public Works, Chicago.
John Mab, Chief Engin'r of Board of Trade, Chic.
C. J. Melmes, Gen'l Sup't Thomson-Houston Light, Omaha, Neb.
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